MULTICAST OPTIMAL ENERGY AWARE ROUTING PROTOCOL FOR MANET BASED ON SWARM INTELLIGENT TECHNIQUES

S. Vimala
Research Scholar, Bharath University, Chennai, India

Dr. V. Khanna
Dean, Informatics, Bharath University, Chennai, India

ABSTRACT

In the past decade optimal multicast energy conservation routing is very big issue. In this paper finding optimal paths in mobile ad hoc networks with minimal energy consumption. More specifically, a novel bi-level optimization model, which allows the reliability, namely breakless path between nodes. With lowest energy consumption to be taken into account simultaneously is presented. In order to evaluate the performance of the proposed model, a hybrid metric space and particle swarm optimization is devised. These hybrid approaches find optimal path and reduce the energy level. The PSO based on swarm intelligence, utilize the information of the best fitness value of the both local best and global best. The metric space analyze significantly reduced delay time to search both host and target nodes in dynamic infrastructure mobile adhoc network. Finally results are more determined, showing the correctness of the proposed model. Indeed, the selection of energy conservative a shorter route leads to a more stable route, but to greater energy consumption.

Key words: WSN, Protocol, MANET, Routing.


1. INTRODUCTION

Recent development of computers and the wireless communication, the mobile computing has already become the field of computer communications in high-level link. Mobile Ad Hoc Network (MANET) [2] is a completely wireless link through the nodes constructed by the actions of the network, which normally has a dynamic structure and a limited bandwidth and other features, network nodes may be inside the laptop, Personal Digital Assistant (PDA)[3], mobile phones, MP3 players, and digital cameras and etc. On the Internet[4], the original Mobility (mobility) is the term used to denote actions source roaming in a different domain; they can retain their own fixed IP address, without the need to constantly changing, which is Mobile IP technology[2]. Mobile IP nodes [4] in the main action is to deal with IP address management, by Home Agent [4] and Foreign Agent to the Mobile Node to packet Tunneling, the Routing and fixed networks are not differ from the original; however, Ad Hoc
Network to be provided by Mobility is a fully wireless [3], can be any mobile network infrastructure, without a base station, all the nodes can be any link, each node at the same time taken.

Router work with the Mobile IP addresses completely various levels of Mobility. Early use of the military on the Mobile Packet Radio[4] Networked in fact can be considered the predecessor of MANET, with the IC technology advances, when the high-tech communication equipment ,the size, weight continuously decreases, power consumption is getting low, Personal Communication System (Personal Communication System, PCS)[5] concept evolved, from the past few years the rapid popularization of mobile phones can be seen to communicate with others anytime, anywhere, get the latest information, or exchange the required information is no longer a dream, And we have gradually become an integral part of life. Military purposes[7], as is often considerable danger in field environment, some of the major basic communication facilities, such as base stations, may not be available, in this case, different units, or if you want to communicate between the forces, we must rely on This cannot MANET network infrastructure limitations. In emergency relief[8], the mountain search and rescue operations at sea, or even have any infrastructure cannot be expected to comply with the topographical constraints and the pressure of time under the pressure, Ad Hoc Network completely wireless and can be any mobile feature is especially suited to disaster relief operations. When personal communication devices and more powerful, some assembly occasions, if you need to exchange large amounts of data, whether the transmission of computer files or applications that display. if we can link into a versatile network zone, then the data transmission will be more efficient without the need for large-scale projection device would not have point to point link equipment (such as network line or transmission line). The current wireless LAN technology, Bluetooth is[9] has attracted considerable attention as a development plan. Bluetooth's aim is to enable wireless devices to contact with each other, if the adding the design of Ad Hoc Network (MANET) [10].

2. RELATED BACKGROUND

Nowadays, the information technology will be mainly based on wireless technology, the conventional mobile network and cellular are still, in some sense, limited by their need for infrastructure for instance based station, routers and so on. For the Mobile Ad Hoc Network, this final limitation is eliminated, and the Ad Hoc Network are the key in the evolution of wireless network and the Ad Hoc Network are typically composed of equal node which communication over wireless link without any central control [2]. Although military tactical communication is still considered as the primary application for Ad Hoc Networks and commercial interest in this type of networks continues to grow. And all the applications such as rescue mission in time of natural disasters, law enforcement operation, and commercial as rescue and in the sensor network are few commercial examples, but in this time it’s become very important in our life and they become use it[3]. The Ad Hoc Networking application is not new one and the original can be traced back to the Defense Advanced Research Projects Agency (DARPA) Packet Radio Networking (PRNET) project in 1972[1, 2, 3] which evolved into the survivable adaptive radio networks (SURAN) program [4] .which was primarily inspired by the efficiency of the packet switching technology for instance the store/forward routing and then bandwidth sharing, it’s possible application in the mobile Ah Hoc Networks environments. as well as in the Packet Radio Networking devises like Repeaters and Routers and so on, were all mobile although mobility was so limited in that time, theses advanced protocol was consider good in the 1970s.after few years advance in Micro

Electronics technology and it’s was possible to integrate all the nodes and also the network devices into a single unit Called Ad Hoc Nodes. And then the advance such as the flexibility, resilience also mobility and independence of fixed infrastructure, and in that time they so interesting to use it immediately among military battlefield, Ad hoc networks have played an important role in military applications and related research efforts, for example, the global mobile information systems (GloMo) program [5] and the near-term digital radio (NTDR) [6] program. And also has been the increase in the
police, commercial sector and rescue agencies in use of such networks under disorganized environments. Ad Hoc network research stayed long time in the realm of the military. And in the middle of 1990s with advice of commercial radio technology and the wireless became aware of the great advantages of Mobile Ad Hoc networks outside the military battlefield domain, and then became so active research work on ad hoc network start in 1995 in the conference session of the Internet Engineering Task Force (IETF) [7]. And then in 1996 this works had evolved into Mobile Ad Hoc Network, in that time focused to discussion cantered in military satellite network, wearable computer network and tactical network with specific concerns begin raised relative to adaptation of existing routing protocols to support IP network in dynamic environments, as well as they make the charter of the Mobile Ad Hoc Network Working Group (MANETWG) of the Internet Engineering Task Force (IETF) also the work inside the MANTs relies on other existing IETF standard such as Mobile IP and IP addressing and most of the currently available solutions are not designed to scale to more than a few hundred nodes. Currently, the research in Mobile Ad Hoc Network became so active and vibrant area and the efforts this research community together with the current and future (MANET) enabling radio technology. Recently, the Ad Hoc Wireless Network and computing consortium was established with the aim to coalescing the interests and efforts to use it anywhere such as academic area and industry and so on. And in order to apply this technology to application ranging for the Home wireless to wide area peer to remote networking and communications. And it’s will certainly pave the way for commercially viable MANET networks and their new and exciting applications, which began to appear in all fields in this life. More recently, the computer has became spread significantly in the all the place and after a pervasive computing environment can be expected based on the recent progresses and advances in computing and communication technologies. Next generation of mobile communications will include both prestigious infrastructure wireless networks and novel infrastructure less mobile ad hoc networks (MANETs).

3. NETWORK ZONE STRUCTURE

The multicast mobile adhoc network structure is hybrid of star and mesh network. This network structure provides a robust and versatile communications network, while maintaining the ability to keep the power consumption of nodes should be minimum. In this network topology, nodes are enabled with multi-hop capability, allowing them to forward messages from the low power nodes to other nodes on the network. Generally, the nodes with the multi-hop capability are higher power, and if possible to enhance the network structure.

![Figure 1 Mesh T Network zone structure](image-url)
4. ENERGY CONSERVATIVE PROTOCOL

Energy conservative protocol model by a simple directed graph $E_g (N, U, W)$, where $N$ is a set of finite nodes $N=\{n_1, n_2, n_3, \ldots, n_i\}$, and $U$ is an arc set unidirectional wireless communication links. The weight function arc set is $W: U \rightarrow R^+$ assigns power to each arc, where $R^+$ denotes the positive real number set. That is, for each arc $(v, u)$, $P_{vu}$ is the power Requirement for the link from source node $S_i$ to destination node $D_i$. Let as assume that any node $S_i$ node, choose its power level, not to exceed threshold value $E_{th}$. This Protocol considers a source-initiated multicast in Mobile ad-hoc networks. The structure of Multicast Mobile ad-hoc networks is virtual hybridization of mesh-tree structure. This network structure gives path stability due to the energy conservative protocol. The energy conservative protocol session durations are generated randomly at the network nodes. The finite set of nodes $M$ that support a multicast session, including the source node, superior node and all destination nodes, is referred to as a multicast tree. Any multicast hybrid (mest) structure is a rooted mest. We define a mest structure as a directed acyclic graph with a source node called root with no incoming arcs, and all its other nodes with exactly one incoming arc. A property of rooted mest is that for any node $n$ in the mest, there exists a single directed path from $s$ to $n$ in the tree. A node with no out-coming arcs is called a leaf node, and all other nodes are internal nodes, or relay nodes. The minimum-energy multicast problem is to find a multicast mest with the minimum power consumption. The protocol involves the choice of transmission power level, hop nodes, antenna beam width, and antenna orientation.

5. PSEUDO CODE FOR ENERGY CONSERVATIVE

Protocol

Begin:
Input: Source Node $S_i$
Output: Destination Node $D_i$

Find the Network Zone Structure $Z_n$
Select the finite set of Group nodes $G_n={g_1,g_2,g_3,g_4..g_n}$, where $G_n \in Z_n$.

Power allocation for each node $P_n={P_1,P_2,P_3,\ldots,P_n}$;

Find the Energy level of each Packet $E_n=[1/T*]$ Where $E_n={E_1,E_2,E_3..E_n}$

Calculate minimum requirement Energy threshold for neighbor node $N_i$

$E_{th}=(1/N)$
Repeat:
If the Energy level of each node $E_i > Eth$ Forward to Neighbor Node ($N_i$)
Else
Remove ($N_i$)
While ($P(N_i)$! =NULL)
$Eth = Eth/2$;
i++; Repeat End:

6. OPTIMAL SHORTEST PATH FIND USING METRIC SPACE ANALYSIS

**Definition**
Let $X$ be a non empty space set. Let $d: X \times X \rightarrow [0, \infty)$ be such that
i) $d(a,b)=0$ for all $a, b \in X$ where $a, b$ are nodes in the optimal path
ii) $d(a,a)=0 \iff a=b$
iii) $d(a,b)=d(b,a)$
iv) $d(a,b) \leq d(a,z)+d(z,b)$ ) $\iff a,b,z \in X$
Where $a, b$, and $z$ are nodes in optimal path then $d$ is called as metric on $x$.
The pair $x, d$ is called metric space (Network Space).

**Convergence**
Let $(x, d)$ be a metric space.
Let $\{x_n\}_{n=1}^{\infty} \subseteq x$ be a sequence of nodes.
We say that sequence of nodes converges to $x$ (a node)
If $\exists >0$ there exists $n \in N$ such that
$d(x_n,x)< \eps \iff n \geq N$.

7. SWARM INTELLEIGENT ROUTING

**Step 1**
When the nodes are dispersed in mesh structure. Swarm particle position is randomly initialized. The position and velocity of node vector represents as $PS_i= (P_i, V)$.

**Step 2**
Each $P_s$ monitors Quality of service parameter (QOS) like node lifetime, link lifetime, and available bandwidth.

**Step 3**
Based on QOS , estimate the fitness function ($F_i$) of each particle $F_i = (a \times X_i^2 + (b \times Y_i) + (c \times A)$
where $a, b$ and $c$ are the weight function.

**Step 4**
The local best ($Lbp$) and global best ($Gbp$) value of fitness and position of each particle is estimated.

**Step 5**
validate the position of $Lbp$ and $Gbp$ based on if-then rule
If $Fi> Fi$ ($Lbpi$)
Then
Validate the position of $L_{bp}$ with the fitness value $F_i$, End if
If $F_i > F_i(G_{bp})$
Then
Validate the position of $G_{bp}$ with fitness value $F_i$, End if

Step 6
Update the velocity and position of each particle using if – then rule

Step 7
The value updated in the global best particle is considered as the best routing path.

Step 8
The predicted QOS parameters are classified using Fuzzy rule based classifier. The classifier to classify whether it is a weak, normal, or strong node.

8. PERFORMANCE METRICS
Performance evaluation of proposed Energy aware optimal routing SIR by comparison with that of RSGM, AODV, SPBM via packet-level simulations in various performance metrics. This Performance are simulated using MATLAB environment. We evaluate the performance of ECPM RSGM, AODV and SPBM various metrics like, Energy level, node life time, link life time and optimal Path length.

8.1. Fuzzy-Based Node Status Estimation
This technique involves the prediction and classification of the node's status by fuzzy logic technique. The steps to determine the fuzzy if-then rule-based interference are as follows:

Fuzzification: In Fuzzy logic, inputs of the nodes of the swarm particles are obtained from the selected input variables and then the degrees to which the inputs belong to each of the suitable fuzzy set are estimated.

![Figure 3 Fuzzy rule node classification](image)

![Figure 4 Status of Nodes in a zone](image)
9. CONCLUSION
In this paper we present a new energy efficient optimal routing protocol in hybrid mesh-tree (mest) structure. This structure gives strong and reliable brakeless packet forward from source to destination nodes. Mmest structure gives energy efficient path from swarm intelligent routing. Our SIR protocol simulated and analyzed using MATLAB. Results are shown SIR has high successful rate, packet delivery ratio, low latency compared with AODV, RSGM, SPBM, RBMP protocols.
REFERENCES


